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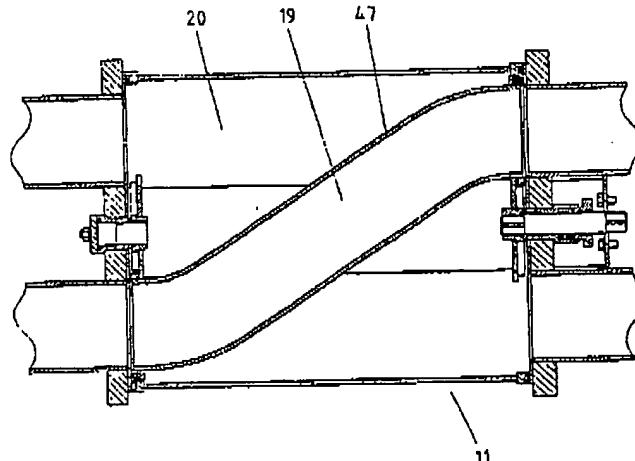
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A VALVE FOR CHANGING THE DIRECTION OF FLOW OF A FLUID IN PIPE CONDUITS



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(57) Abstract: The invention relates to a valve and a use of a valve. The valve is intended for changing the direction of flow of a fluid in pipings conducting the fluid to and from a heat exchanger, respectively. Heat exchangers used in systems in which one take cooling water from natural water streams, river water, seawater etc. often have problems with clogging. One way of keeping the heat exchanger clean is to back flush it regularly, that is to reverse the direction of the flow for example a few a few times a day such that mud and particles stuck in the inlet region of the heat exchanger is flushed out the same way as it came in. The valve the invention concerns consists of a cylindrical casing and a valve body enclosed therein which can be rotated between two positions. The valve body has three flow passages (17, 18 and 19). A fourth flow passage (20) is constituted by the space between the house of the valve and respective walls around the flow passages in the valve body. The realization means that the entire valve is being flushed by the fluid during operation and the risk for accumulation of dirt in the valve is eliminated.

A VALVE FOR CHANGING THE DIRECTION  
OF FLOW OF A FLUID IN PIPE CONDUITS.

5

The present invention relates to a valve for changing the direction of flow of a fluid in pipe conduits conducting the fluid to and from a heat exchanger, respectively, said valve comprising a 10 rotateable valve body and an enclosing valve house consisting of a cylindrical casing with end plates, wherein said valve body is rotatable around a rotary axis coinciding with a thought centre line of the cylindrical casing, and four flow passages extending through the valve house and being oriented in such a way that 15 two diametrically located flow passages are approximately parallel with the rotary axis of the valve body and that the two other flow passages extend obliquely through the valve house, and, when the valve body is rotated into a first position, the flow passages connect a first connection port in the first end plate with a first connection port in the second end plate, and a second connection port in the first end plate with a second connection port in the second end plate, respectively, and, when the valve body is rotated into a second position, the flow passages connect a 20 first connection port in the first end plate with a second connection port in the second end plate and a second connection port in the first end plate with a first connection port in the second end plate, respectively. 25

Heat exchangers used in systems in which cooling water is 30 taken from natural water streams, river water, seawater etc. often show problems with clogging. Partly, it may depend on mud and particles jamming the cooling channels and partly on biological growth.

35 A simple and environmentally harmless way to keep a heat exchanger tolerably clean is to back flush the heat exchanger

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regularly, i.e. the direction of flow is reversed for example one or a few times each day. By reversing the direction of flow, mud and particles clogging the inlet region of the heat exchanger will be flushed out the same way it came in.

5

Back flushing of heat exchangers is also used to in some industrial processes in which fluids with large amounts of fibers are present, for example during the production of raw sugar. Fluid with cut down beats is to be heated and cooled in heat exchangers, and in order for the heat exchangers not to be clogged they must be back flushed regularly.

A back flushing valve of a similar kind as the one included by the invention, is previously known from for example SE 504 895, 15 which describes a valve being used together with a heat exchanger to make back flushing possible. This valve consists of a valve house with a cylindrical casing and two end plates, and inside the valve house there is a rotatable valve body, by which the direction of flow can be reversed. The valve body in this 20 valve has four flow passages and in order to keep the size of the valve down at least two of the flow passages have a non circular cross section in the middle portion of the valve body.

In a preferred embodiment of the valve body, the flow passages 25 are realized as four separate pipes, two of which have a non circular cross section in the middle portion. The shapes of these two pipes are quite complex and demand a complicated and expensive method of production. Special shaping tools, one set for each size, must be produced.

30.

Another difficulty with the known valve according to SE 504 895 is that dirt and particles are collected in the space between the cylindrical casing and the pipes, and if a too large amount is accumulated the rotation of the valve body can be difficult or in the 35 worst case be prevented. In order to secure the rotating function, the valve house has to be drained regularly during opera-

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tion, which means that the valve house must be provided with a drain connection. Since the valve in most cases is to be operated without manual control, it is demanded that the drain connection is opened and closed by means of a controlled valve, 5 which complicates the installation of the back flushing valve and makes it more expensive.

The purpose of the present invention is to reduce the costs of manufacturing and installation of the back flushing valves considerably, and to achieve a back flushing valve that is simpler to 10 operate than the one according to SE 504 895.

These and other purposes are achieved according to the invention by a valve of the construction initially defined, which has 15 been given the characteristics specified in claim 1. Preferred embodiments of the valve according to the invention have further been given the characteristics defined in claims 2 to 6. The invention also relates to a use of the valve, the use being given the characteristics defined in claim 7.

20 A possible embodiment of the invention is described below with reference to figures 1 - 13.

Fig. 1 schematically shows a plate heat exchanger, a back 25 flushing valve and pipe conduits conducting fluid to and from the heat exchanger, respectively.

Fig. 2 shows an inclined projection of the back flushing valve.

30 Fig. 3 schematically shows a valve body and a principle for the layout of the flow passages.

Fig. 4 shows a side view of the back flushing valve.

35 Fig. 5 shows a view of the left end of the back flushing valve in Fig. 4.

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Fig. 6 shows a view of the right end of the back flushing valve in Fig. 4.

- 5 Fig. 7 shows a cross section along the line I-I through the back flushing valve in Fig. 6 with the valve body in a normal position.

Fig. 8 and 9 show the marked areas in Fig. 7 scaled up.

- 10 Fig. 10 shows a cross section along the line I-I through the back flushing valve in Fig. 6, with the valve body in a back flushing position.

- 15 Fig. 11 shows a view of the valve body in the same position as in Fig. 7.

Fig. 12 shows a view of the valve body in the same position as in Fig. 10.

- 20 Fig. 13 shows a view of the right end of the valve body in Fig. 11.

In Fig. 1 a plate heat exchanger 1 and a back flushing valve 2 being mounted on an inlet and outlet conduit 3 and 4, respectively, is shown. During normal operation the valve body of the back flushing valve is suitably rotated into a first position such that the inlet conduit 3 is connected with the port 5 of the heat exchanger and the outlet conduit 4 with the port 6, via two flow passages in the valve body. During normal operation the port 5 is an inlet port and the port 6 is an outlet port.

During back flushing the valve body is rotated into a second position such that the inlet pipe 3 becomes connected with the port 6, and the outlet pipe 4 with the port 5, which means that the port 6 becomes the inlet port and the port 5 becomes the outlet

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port. The construction and the function of the back flushing valve is described in greater detail in connection to Figs. 2-13.

In Fig. 2 the back flushing valve is shown in an inclined projection. The valve house 11 consists of two plane end plates 7 and 8, respectively, and a casing 9. A screw joint 10 keeps the end plates and the casing together. On both the end plates 7 and 8 there are protruding connection pipes 12, 13, 14 and 15, which are connected to the pipe conduits conducting fluid to and from the heat exchanger, respectively.

In Fig. 3, the valve body 16 is shown schematically in the position it has during normal operation when it is mounted in a valve and oriented as the back flushing valve in Fig. 2. Four flow passages 17-20 extend between the end plates, three of which are tubular and debouche into both ends of the valve body with the openings 17a-19a and 17b-19b, respectively. The flow passage 20 is constituted of the remaining space in the valve house. The openings are placed with a uniform division 90° on the same distance from the rotary axis 21 of the valve body. The flow passages 17 and 18 are approximately parallel with the thought length axis of the valve body, which also constitutes its rotary axis. During normal operation the valve body is suitably rotated such that the flow of fluid passes through the flow passages 17 and 18, so that the back flushing valve does not give rise to a higher pressure drop than pipe conduits with a corresponding length would give.

The flow passage 19 extends obliquely through the valve body in such a way that the openings 19a and 19b in the ends are displaced 180°. If the valve body in Fig. 3 is enclosed in the valve house 11 in Fig. 2, and rotated 90° around its length axis, in such a way that the connection pipe 12 is connected with the connection pipe 15, the connection pipe 13 will be connected with the connection pipe 14. Thus the change of the direction of the fluid, which is the purpose of the invention, is achieved.

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On one of the end plates there is a control device 22, which appears from the Figs. 4 and 6. With the help of the control device the valve body can be rotated 90° from a normal position to the 5 back flushing position and vice versa. The rotational motion of the control device is transferred to the valve body through a shaft 23. Different types of control devices can be used, pneumatic, hydraulic and electric. The back flushing valve does not necessarily need to have a control device but may also be rotated manually.

Figs. 5 and 6 show the two end plates 7 and 8 with the respective connection ports 12a and 13a, and 14a and 15a, respectively, through which the fluid flows to and from the valve house.

15 From Figs. 7, 8 and 9, the construction of the back flushing valve is evident in greater detail. In the valve house the valve body 16 is shown with the flow passages 17 and 18, which are limited by the two straight pipes 24 and 25, respectively. The 20 pipes are attached to one end plate 26 and 27 in each end such that these together with the pipes constitute a connected unit rigid to bending and torsion. Around the pipe ends there are sealings 28 minimising the through leakage from the inlet pipe to the outlet pipe. Due to the pressure drop in the heat exchanger 25 a pressure difference arises between the inlet and outlet, and without the sealings a significant portion of the flow would pass through the valve house instead of through the heat exchanger.

The end plates consist of plane, relatively thick rounds of pressure vessel steel. In order to avoid corrosion on the end plates 30 there is a thin sheet 29 of material resistant to corrosion on the inside of the respective end plate. In each end plate there are two connection pipes 12 and 13, and 14 and 15, respectively, and these are joined with the respective sheet 29 by for example welding, such that pressure-tight joints are achieved. In the 35

centre of each end plate there is a sleeve 30 and 31, respectively, which are also pressure-tightly joined to the sheet 29.

- 5 A shaft 32 extends through the sleeve 30 into a hub 33 located in the centre of the end plate 26, and the valve body may rotate around the shaft. The hub 33 is provided with a bearing 34, in order to decrease the friction resistance and the wear. The shaft is shaped with a larger outer portion and the shoulder 32a thus produced fixes the position of the shaft together with the cap 35.
- 10 The cap is attached with a screw joint 36, and a gasket 37 is provided between the cap and the sleeve, which gasket prevents the medium in the valve house from leaking.

- 15 The rotation device 22 is mounted on an attachment sheet 38 on the end plate 8; however, the rotation device is not shown in Fig. 7. The shaft 23 transferring the rotational motion from the rotation device to the valve body is formed with a square cross section at the ends. These fit holes with corresponding shape in the rotation device and the hub 39, respectively, and the shaft 20 can thus transfer a relatively large torque. The sleeve 31 is provided with a bearing 40 in order to decrease the friction to the shaft, and a box type sealing 41 preventing leakage between the sleeve and the shaft. The box type sealing is held compressed with the help of a gland 42, which in turn is attached with the 25 screw joint 43 as shown in Fig. 4.

- 30 The casing limiting the valve house in a radial direction consists of a cylindrical shell 44 and two flange rings 45, which are pressure-tightly joined to each other by for example welding. Each flange ring is formed with a groove in the surface facing the adjacent end plate, and in the groove a sealing ring 46 is located. When the back flushing valve is mounted the screw joint 10 holds the end plates 7 and 8 pressed against the casing, which means that the sealing rings will be compressed and thus may 35 seal between the end plates and the flange rings.

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Fig. 10 is identical with Fig. 7 apart from the valve body being rotated 90° around its rotary axis. With the valve body in this position, the section I-I intersects the flow passages 19 and 20 along their length. The flow passage 19 is limited by a double-bended pipe 47. The flow passage 20 is limited by the valve house 11 and the respective wall around the three flow passages 17-19, that is, the flow passage 20 is constituted by the entire space in the valve house, which is not occupied by the flow passages 17-19.

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In Fig. 11 the valve body is shown in the same position as in Fig. 7, but is here not in section. The arrows indicate thought flows through the back flushing valve to and from a heat exchanger, respectively, when it is in a preferred normal position.

15

In a corresponding way Fig. 12 shows the valve body in Fig. 10. If the lower arrow in Fig. 11 indicates a flow to a heat exchanger and the upper arrow the flow from, the flows through the back flushing valve will in a preferred back flushing position have directions according to the arrows in Fig. 12. The flow to the heat exchanger flows through the flow passage 19, and the flow from the heat exchanger flows through the flow passage 20, which is limited by the valve house 11 and the respective wall around the three flow passages 17-19.

20

By configuring the valve with three tubular flow passages and using the space outside them to the fourth flow passage, the entire valve will be flushed by the fluid during operation and the risk of accumulation of dirt in the valve will be eliminated.

25

Fig. 13 shows the end plate 27 and the three pipes 24, 25 and 47, and three support rings 48 concentrically positioned around the respective pipe. Between the pipes and the support rings grooves are formed, in which the sealings 28 are mounted.

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From Figs. 11, 12 and 13 it is evident that the three pipes 24, 25 and 47 are formed with a circular cross section along the whole length of the respective pipe, which means that the valve body may be manufactured with standardised pipe components. Thus  
5 expensive tools for manufacturing the pipes are avoided.

Since the flow passage 20 is constituted of the entire space in the valve house, which is not taken up by the flow passages 17-19, the corresponding flow path has a cross section area which  
10 is considerably larger than the connected connection pipes. In order to decrease the pressure drop when the fluid flows from a connecting pipe into the flow passage 20, the valve body may be provided with an expansion nozzle right in front of the connection port where the fluid is flowing in. The expansion nozzle is  
15 preferably shaped by a sheet into a tubular device with a successively increasing cross section area.

The connection pipes on the back flushing valve shown are shown without flanges or other types of pipe connections but  
20 they can of course be provided with such connections. The embodiment shown allows the back flushing valve to be taken apart for maintenance when it is mounted to connecting pipe conduits, which means that the connection pipes and pipe conduits can be joined permanently for example by welding, without causing any  
25 inconvenience during maintenance work.

In the embodiments of the back flushing valve described above metal is preferably used for most of the components but other materials such as for example reinforced plastics can also be  
30 used if the construction is modified.

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## CLAIMS

1. A valve (2) for changing the direction of flow of a fluid in pipe conduits (3,4) conducting the fluid to and from a heat exchanger (1), respectively, said valve (2) comprising a rotatable valve body (16) and an enclosing valve house (11) consisting of a cylindrical casing (9) with end plates (7,8), wherein said valve body is rotatable around a rotary axis (21) coinciding with a thought centre line of the cylindrical casing, and four flow passages (17-20) extending through the valve house and being oriented in such a way that two diametrically positioned flow passages (17,18) are approximately parallel with the rotary axis of the valve body and that the two other flow passages (19,20) extend obliquely through the valve house, and when the valve body is turned into a first position the flow passages (17,18) connect a first connection port (12a) in the first end plate (7) with a first connection port (14a) in the second end plate (8), and a second connection port (13a) in the first end plate with a second connection port (15a) in the second end plate, respectively and, when the valve body is turned into a second position, the flow passages (19,20) connect the first connection port in the first end plate with a second connection port in the second end plate, and the second connection port in the first end plate with the first connection port in the second end plate, respectively

characterised in that the valve body comprises three tubular flow passages (17,18,19) and that the remaining flow passage (20) is constituted by the space between the valve house and the respective walls around the three flow passages in the valve body.

2. A valve according to claim 1, characterised in that the valve house has two plane and essentially evenly thick end plates (7,8), each of which has two diametrically positioned connection ports, positioned in such a way that the connection ports (12a,

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13a) in one end plate (7) are approximately aligned with the connection ports (14a, 15a) in the second end plate (8).

3. Valve according to claim 1 or 2, characterised in that the  
5 valve house (11) consists of a cylindrical casing (9) and two re-  
movable end plates (7,8), and that the end plates are held at-  
tached to the casing with a screw joint along the outer rims of  
the end plates.
- 10 4. Valve according to claim 3, characterised in that a screw  
joint (10) extends between the end plates (7,8) in such a way  
that they are pressed against the casing (9) during tightening of  
said screw joint.
- 15 5. Valve according to claim 1 and 2, characterised in that the  
cylindrical casing has at least one permanently mounted end  
plate.
- 20 6. A valve according to any of the previous claims, charac-  
terised in that at least one end plate has a protruding pipe con-  
centrically positioned around one of the connection ports, and  
that the pipe is parallel with the rotary axis (21) of the valve  
body (16).
- 25 7. Use of a valve according to any of the previous claims,  
characterised in that the valve is intended to turn the direction  
of the flow of a fluid in a heat exchanger (1).

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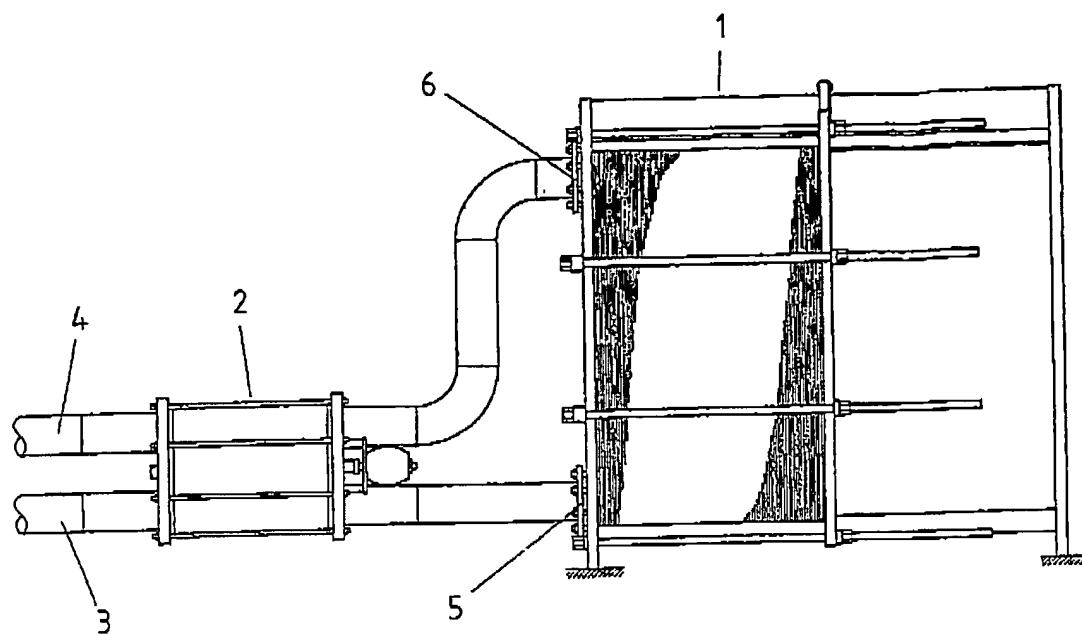


Fig.1

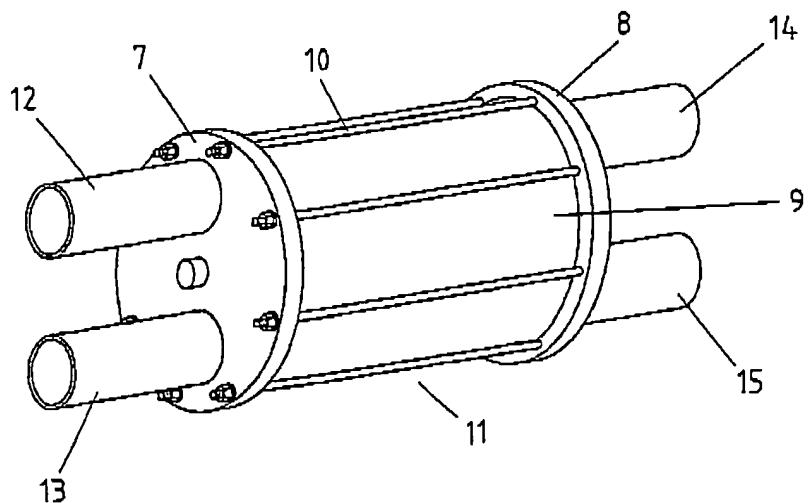


Fig.2

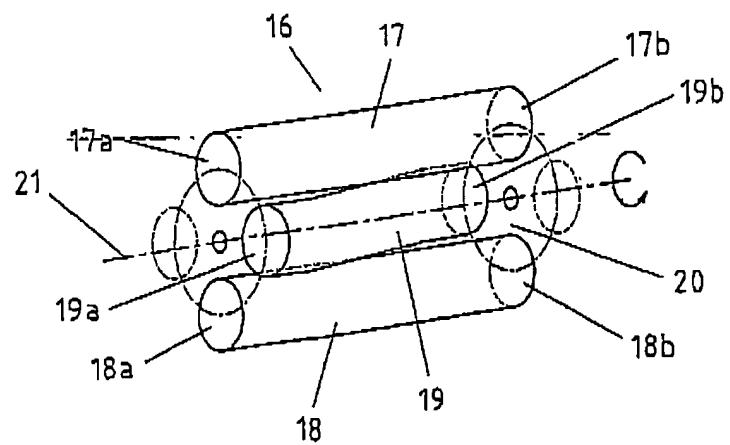
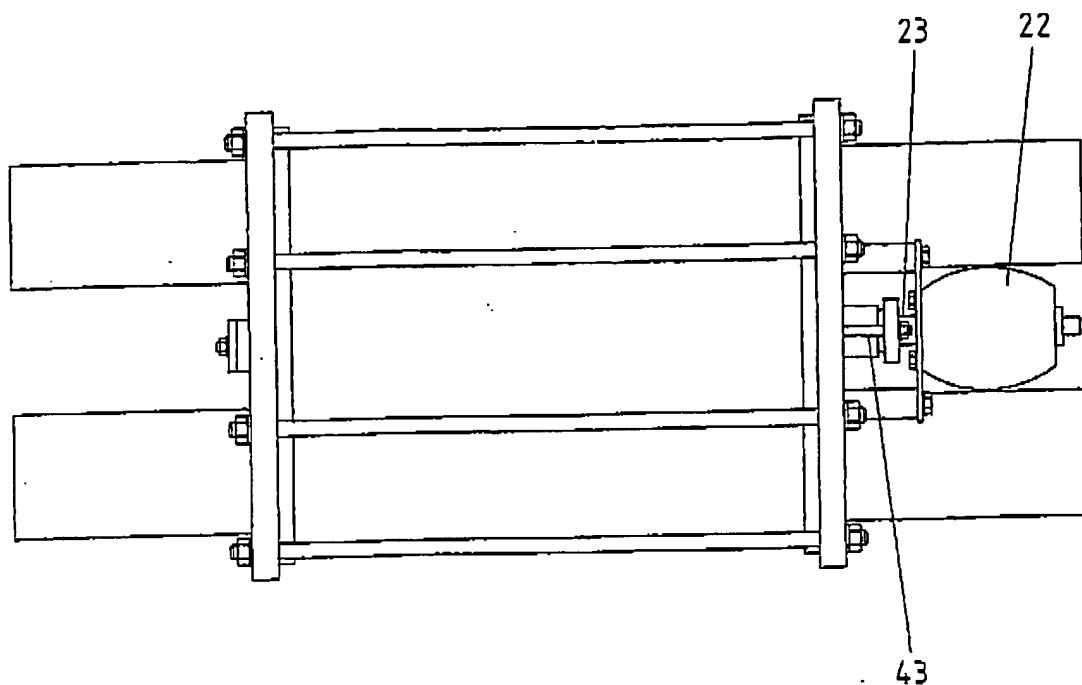
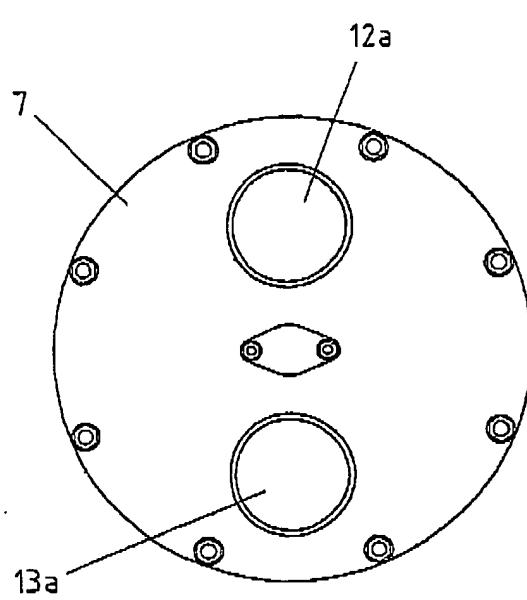
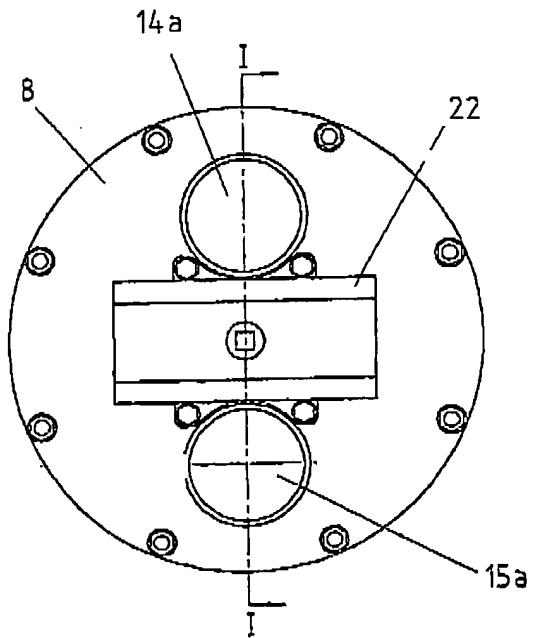
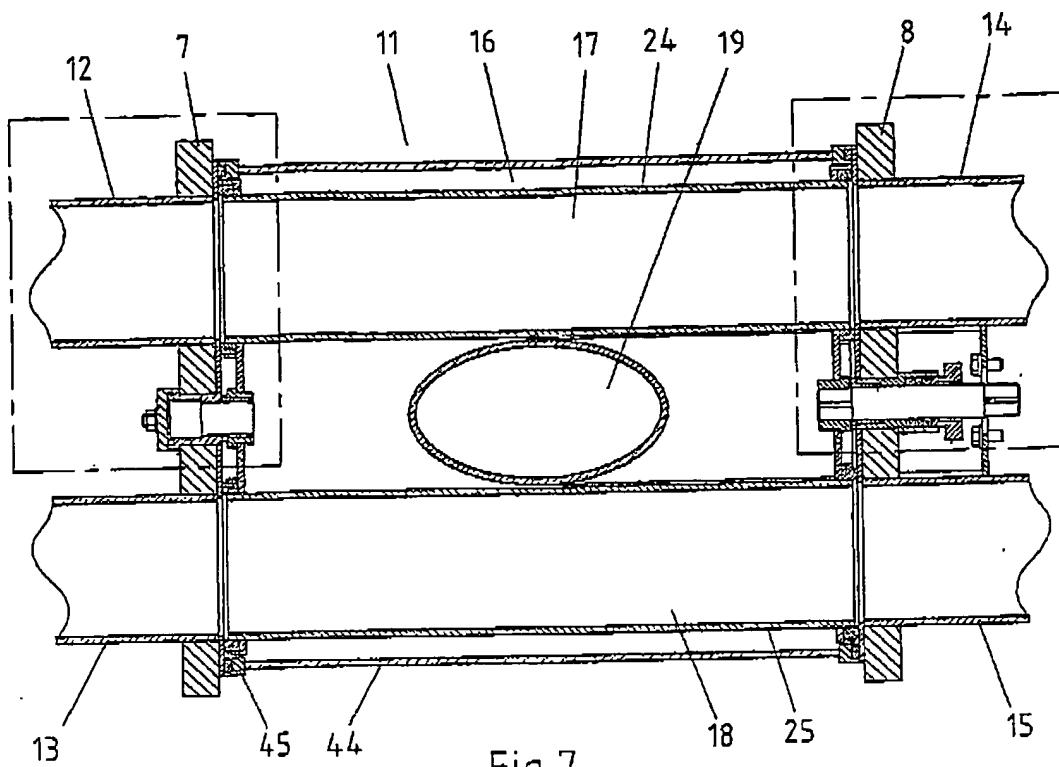
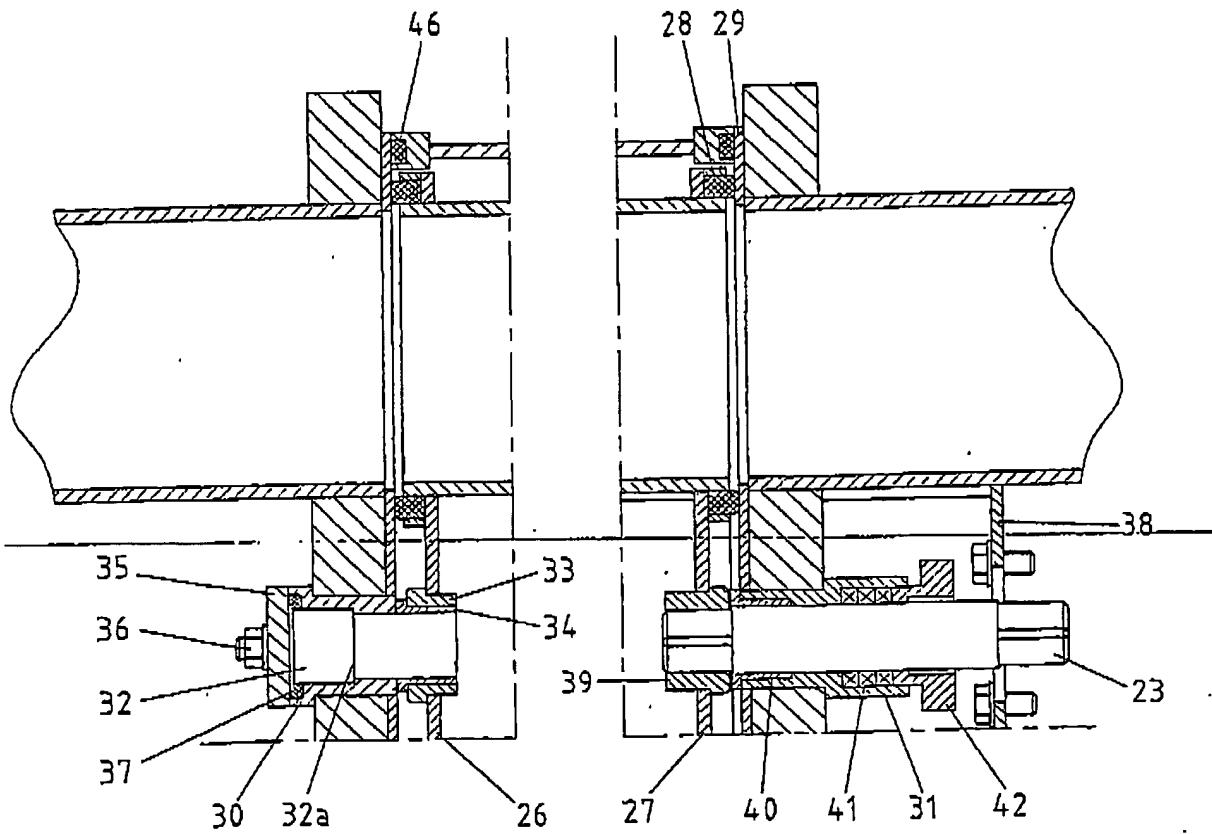


Fig.3

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Fig.4Fig.5Fig.6

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Fig. 7Fig. 8Fig. 9

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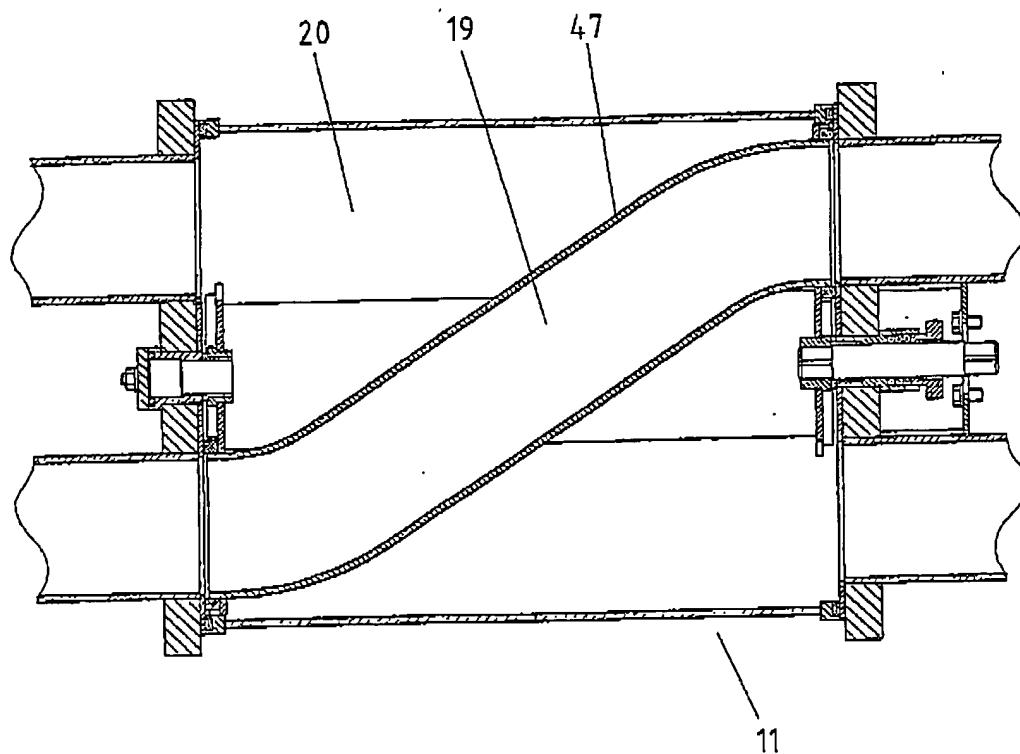


Fig.10

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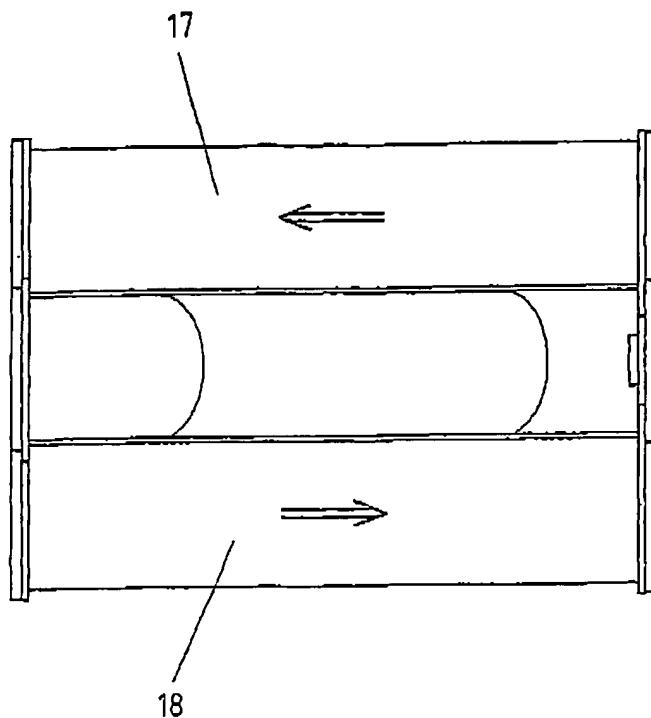


Fig.11

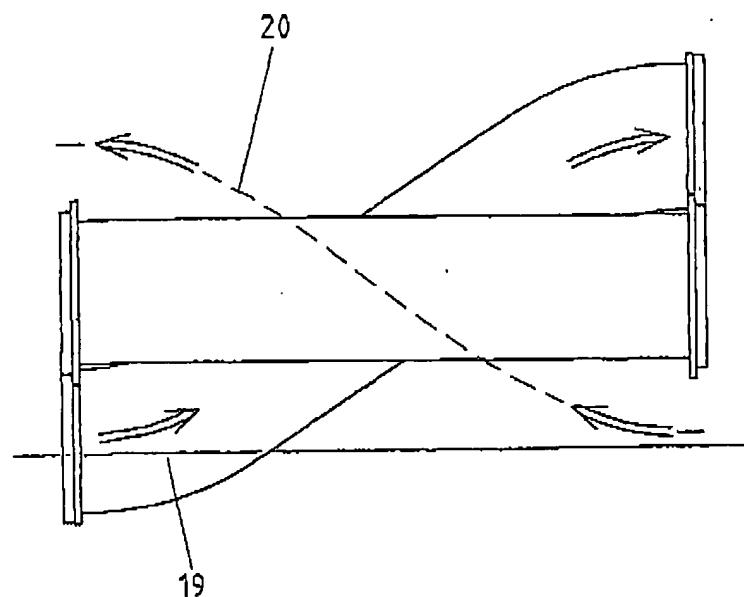


Fig.12

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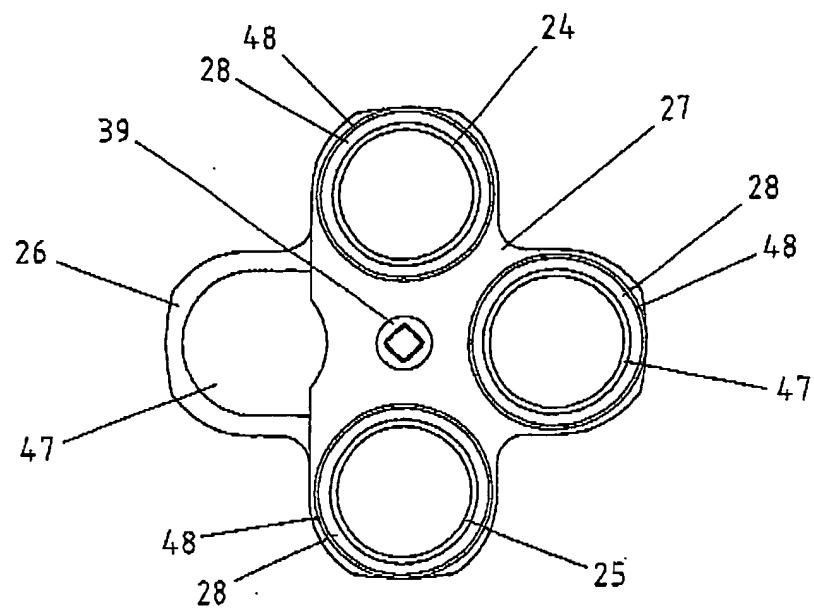


Fig.13

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/01201

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC7:** F16K 11/074, F28G 9/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC7:** F16K, F28G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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Date of the actual completion of the international search	Date of mailing of the international search report
10 October 2003	16-10-2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer  Malin Hallmén / JA A Telephone No. + 46 8 782 25 00

## INTERNATIONAL SEARCH REPORT

International application No.
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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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From the INTERNATIONAL BUREAU

**PCT****NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES**

(PCT Rule 47.1(c), first sentence)

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**BJERKÉNS**

Date of mailing (day/month/year) 05 February 2004 (05.02.2004)
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Applicant's or agent's file reference 55850 PCT sb/mw	<b>IMPORTANT NOTICE</b>	
International application No. PCT/SE2003/001201	International filing date (day/month/year) 10 July 2003 (10.07.2003)	Priority date (day/month/year) 31 July 2002 (31.07.2002)
Applicant  MARINNOVATION HB et al		

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this notice:

AU, AZ, BY, CH, CN, CO, DE, DZ, EP, HU, JP, KG, KP, KR, MD, MK, MZ, RU, TM, US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE, AG, AL, AM, AP, AT, BA, BB, BG, BR, BZ, CA, CR, CU, CZ, DK, DM, EA, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, ID, IL, IN, IS, KE, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MG, MN, MW, MX, NI, NO, NZ, OA, OM, PG, PH, PL, PT, RO, SC, SD, SE, SG, SK, SL, SY, TJ, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this notice is a copy of the international application as published by the International Bureau on 05 February 2004 (05.02.2004) under No. WO 2004/011834

4. **TIME LIMITS for filing a demand for international preliminary examination and for entry into the national phase**

The applicable time limit for entering the national phase will, subject to what is said in the following paragraph, be 30 MONTHS from the priority date, not only in respect of any elected Office if a demand for international preliminary examination is filed before the expiration of 19 months from the priority date, but also in respect of any designated Office, in the absence of filing of such demand, where Article 22(1) as modified with effect from 1 April 2002 applies in respect of that designated Office. For further details, see *PCT Gazette* No. 44/2001 of 1 November 2001, pages 19926, 19932 and 19934, as well as the *PCT Newsletter*, October and November 2001 and February 2002 issues.

In practice, time limits other than the 30-month time limit will continue to apply, for various periods of time, in respect of certain designated or elected Offices. For regular updates on the applicable time limits (20, 21, 30 or 31 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at <http://www.wipo.int/pct/en/index.html>.

For filing a demand for international preliminary examination, see the *PCT Applicant's Guide*, Volume I/A, Chapter IX. Only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination (at present, all PCT Contracting States are bound by Chapter II).

It is the applicant's sole responsibility to monitor all these time limits.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer  Gijsbertus Beijer - Carlos Roy
Facsimile No.(41-22) 740.14.35	Telephone No.(41-22) 338.91.11

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>55850 PCt sb/mw</b>	<b>FOR FURTHER ACTION</b>	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. <b>PCT/SE 03/01201</b>	International filing date ( <i>day/month/year</i> ) <b>10 July 2003</b>	(Earliest) Priority Date ( <i>day/month/year</i> ) <b>31 July 2002</b>
Applicant <b>Marinovation HB et al</b>		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.  
 the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2.  Certain claims were found unsearchable (See Box I).

3.  Unity of invention is lacking (See Box II).

## 4. With regard to the title,

- the text is approved as submitted by the applicant.
- the text has been established by this Authority to read as follows:  
**A valve for changing the direction of flow of a fluid in pipe conduits.**

## 5. With regard to the abstract,

- the text is approved as submitted by the applicant.
- the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. 10

- as suggested by the applicant.
- because the applicant failed to suggest a figure.
- because this figure better characterizes the invention.

 None of the figures.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/01201

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC7: F16K 11/074, F28G 9/00**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC7: F16K, F28G**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**EPO-INTERNAL, WPI DATA, PAJ**

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4445540 A (BARON ET AL), 1 May 1984 (01.05.84) --	1-7
A	DE 3727467 A1 (MESROC GMBH), 2 March 1989 (02.03.89) --	1-7
A	US 4506703 A (BARON), 26 March 1985 (26.03.85) --	1-7
A	GB 324239 A (EDWARD ALEXANDER STANLEY SWINSON), 23 January 1930 (23.01.30) --	1-7

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y"	document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

Date of mailing of the international search report

10 October 2003

16 -10- 2003

Name and mailing address of the ISA/  
Swedish Patent Office  
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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/0201

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 3147511 A1 (HEEREN, HEERO ET AL), 9 June 1983 (09.06.83) -- -----	1-7

## INTERNATIONAL SEARCH REPORT

Information on patent family members

06/09/03

International application No.

PCT/SE 03/01201

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US	4445540	A 01/05/84	CA EP JP JP JP ZA	1188198 A 0077880 A 1297339 C 58084291 A 60018872 B 8204562 A	04/06/85 04/05/83 20/01/86 20/05/83 13/05/85 28/12/83
DE	3727467	A1 02/03/89	AU WO ZA	2256588 A 8901600 A 8806073 A	09/03/89 23/02/89 25/10/89
US	4506703	A 26/03/85	AU CA EP JP US ZA EP ES ES JP ZA	1837483 A 1206393 A 0122960 A 59170572 A 4543996 A 8306312 A 0183898 A 541274 A 8607505 A 61136068 A 8500553 A	20/09/84 24/06/86 31/10/84 26/09/84 01/10/85 25/07/84 11/06/86 16/05/86 01/11/86 23/06/86 28/05/86
GB	324239	A 23/01/30	NONE		
DE	3147511	A1 09/06/83	BR ES ES IL ZA	8207052 A 517826 A 8308016 A 67354 D 8208790 A	11/10/83 16/08/83 01/11/83 00/00/00 26/10/83